

CRUISE REPORT¹

VESSEL: *Hi'ialakai*, Cruise 05-01 (Fig. 1)
CRUISE

PERIOD: 04 April-23 April 2005

AREA OF OPERATION: Northwestern Hawaiian Islands (NWHI)

TYPE OF OPERATION: The Coral Reef Conservation Program (CRCP) conducted high-resolution, multibeam-based surveys to define the 25-fathom isobath surrounding Nihoa and to develop benthic habitat maps of the seabed surrounding French Frigate Shoals, Necker Island (Mokumanamana), and Nihoa Island. Oceanographic moorings were serviced to continue remote long-term monitoring of oceanographic and environmental conditions at Necker Island and French Frigate Shoals.

ITINERARY:

- 4 April Start of cruise. Embarked Scott Ferguson (Chief Scientist-Mapping Team), Joyce Miller (Mapping Team, Survey Lead), Jeremy Jones (Mapping Team/Mooring Diver), Jonathan Weiss (Mapping Team), Emily Lundblad (Mapping Team), Joe Chojnacki (Mapping Team/Mooring Diver), Kyle Hogrefe (Mooring Team Leader/Mapping Team), Allysa Aaby (Mapping Team), Rob O'Conner (Mapping Team), Shannon Byrne (Senior Engineer), John Kiernen (Systems Engineer) and Melissa Fye (Teacher at Sea). The R/V *AHI* (Acoustic Habitat Investigator) is carried in the starboard cradle on the 02 deck. Departed Honolulu at 1600, after a delay caused by replacing the generator on the R/V *AHI*. Conducted a brief survey of the shelf near Barber's Point, Oahu at the request of NOAA's Marine and Aviation Operation (NMAO) to locate a suitable site for EM3002 certification trials. Departed for Nihoa Island.
- 5 April Conducted training in multibeam operation and theory for mapping personnel and ship's personnel. Conducted safety drills. Completed generator installation on R/V *AHI*. Conducted reconnaissance mapping at Nihoa Island to delineate the 25-fathom isobath. Conducted engineering trials of ISS2000 (Integrated Survey System). Departed for Necker Island (Mokumanamana).

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- 6 April Transited past Necker Island, surveying the northern shelf bank. Transited to French Frigate Shoals (FFS), mapping along a transect through the deep banks between Necker and FFS. Engineering trials of ISS2000 system continued at times during the mapping.
- 7 April Arrived at FFS and began mapping on the western bank of the reef complex. Engineering trials for the ISS2000 continued at times during the mapping. The R/V *AHI* was launched and its generator tested, then an initial roll bias calibration was conducted.
- 8 April Disembarked Science Applications International Corp. (SAIC) engineers Byrne and Kiernan at Tern Island for a flight to Honolulu. The R/V *AHI* conducted a test to confirm the roll bias calibration and then began survey operations. Supplies were transferred from the ship to the U.S. Fish and Wildlife (USFWS) field station at Tern Island, and the *AHI*'s repaired generator was transferred to the ship as a spare unit. The *Hi'ialakai* resumed survey operations.
- 9 April Continued ship-based and launch-based mapping operations on the western banks of FFS. Departed for Necker Island with ship-based mapping continuing during the transit.
- 10 April Arrived Necker Island. Recovered Ocean Data Platform (ODP) instrument package and reinstalled new instrument package on existing anchor. Previously installed Sea Surface Temperature (SST) buoy was missing. Installed new SST buoy and anchor. Deployed a Subsurface Temperature Recorder (STR). Conducted ship-based mapping operations while mooring work was being performed. Departed for Bank 66 to conduct ship-based mapping operations en route to FFS.
- 11 April Conducted survey of Bank 66. Arrived at FFS. Resumed launch-based and ship-based mapping operations on the western banks of FFS. Recovered Coral Reef Early Warning System (CREWS) buoy and reinstalled new buoy on existing anchor. Deployed a Subsurface Temperature Recorder (STR). Recovered prototype Ghostnet debris tracking buoy and replaced with a production model. Installed Semi-permeable Membrane Device (SPMD).
- 12 April Continued launch-based and ship-based mapping operations on the western banks of FFS. Conducted safety drills.
- 13 April Continued launch-based and ship-based mapping operations on the western banks of FFS.
- 14 April Continued launch-based and ship-based mapping operations on the western banks of FFS. The ship's crew and scientific party toured the USFWS field station at Tern Island.

- 15 April Continued launch-based and ship-based mapping operations on the western banks of FFS. Continued ship-based mapping operations on the east side of FFS during night hours. Conducted comparisons between all sources of sound velocity being used on the cruise. Began testing of ship's Trackpoint II Plus underwater navigation system. Conducted engineering trials with the Tethered Optical Assessment Device (TOAD) camera sled to test new lighting systems and positioning of the camera sled using the Trackpoint II.
- 16 April Continued launch-based and ship-based mapping operations on the western banks of FFS. Continued ship-based mapping operations on the east side of FFS during night hours. Conducted engineering trials with the TOAD camera sled to test the ability of the Trackpoint II navigation system to track a vehicle being towed from the A-frame. Tested the ability of the Trackpoint II system to track the conductivity-temperature-depth (CTD) sensor when deployed to 300 meters.
- 17 April Continued launch-based and ship-based mapping operations on the western banks of FFS. Conducted a dive on the ship's hull to verify the installation of the Trackpoint II transducer and document the condition of the other transducers. Commenced ship-based mapping of Brooks Bank.
- 18 April Continued ship-based mapping of Brooks Bank. Conducted safety drills. Continued launch-based and ship-based mapping operations on the western banks of FFS. Conducted a TOAD deployment to test using Trackpoint II and Hypack to provide geo-referenced track tows. Departed for Necker Island with ship-based mapping en route.
- 19 April Conducted ship-based mapping of the northern and eastern banks of Necker Island. Poor weather precluded collection of good multibeam data when headed into the seas, so mapping at Necker was halted early. Departed for Nihoa with limited ship-based mapping en route.
- 20 April Arrived Nihoa. Conducted ship-based mapping to delineate the 25-fathom isobath on the banks surrounding Nihoa.
- 21 April Conducted ship-based mapping to delineate the 25-fathom isobath on the banks surrounding Nihoa.
- 22 April Conducted ship-based mapping to delineate the 25-fathom isobath on the banks surrounding Nihoa. Departed for Honolulu.
- 23 April Arrived Honolulu. Disembarked Ferguson, Miller, Jones, Weiss, Lundblad, Chojnacki, Hogrefe, Aaby, O'Conner, and Fye.

CRUISE STATISTICS:

	Nihoa	Necker	FFS	Transits	Totals	Comments
SST buoys deployed	0	1	1		2	FFS buoy is a moored ATI Drifter replacement.
SST buoys recovered	0	0	1		1	Necker SST not present.
STR deployed	0	1	1		2	Deployments associated with Necker SST and FFS CREWS.
CREWS deployed	0	0	1		1	
CREWS recovered	0	0	1		1	
ODP deployed	0	1	0		1	
ODP recovered	0	1	0		1	
SPMD deployed	0	0	2		2	Both deployed at one site.
Shallow water CTDs	0	1	1		2	
TOAD transects	0	0	4		4	
Multibeam Coverage, sq. km	78.5	8.6	284.5*	not yet totaled	370.7	
<i>Hi'ialakai</i> : Multibeam survey days.	3	2	11	3	19	
<i>Hi'ialakai</i> : CTDs						
<i>R/V AHI</i> : Multibeam survey days.	0	0	11		11	
<i>R/VAHI</i> : CTDs	0	0				

* Includes East Brooks Bank

MISSIONS AND RESULTS:

A. Delineate the 25-fathom isobath of the banks surrounding Nihoa Island.

- Two days of surveys were conducted at Nihoa to delineate the 25-fathom isobath. In addition to the isobath surrounding Nihoa, one area shoaler than 25 fathoms was identified to the north of Nihoa and one small pinnacle shoaler than 25 fathoms was identified on the eastern portion of the bank. The size of the bank precluded surveying the entire area, but soundings on the existing nautical charts were used to guide work performed and all areas with charted soundings shoaler than 28 fathoms were investigated. Two hundred thirty-eight sq. km of bank top was surveyed with approximately one-third of the area being covered by the multibeam swath, yielding survey coverage of 78.5 sq. km. Figure 2 shows the multibeam coverage and the approximate location of the 25-fathom (45.7 meter) isobath at Nihoa.

- B. Conduct benthic habitat mapping of the reefs and submerged banks surrounding French Frigate Shoals and Necker Island using ship-based and launch-based multibeam echosounders and underwater towed cameras.
1. Eleven days of surveys were conducted on the banks surrounding FFS. Almost complete coverage was achieved in a 207-sq. km area on the western bank in water depths between 20 and 100 meters. In addition, data were acquired to fill most of the gaps between data acquired at 25 and 100 fathoms by the *Kilo Moana* in 2002. Figure 3 shows the multibeam coverage of the western bank of French Frigate Shoals. Other survey work was conducted to complete coverage between 100 and 500 meters.

East Brooks Bank, which lies approximately 45 km northwest of FFS, was surveyed as well. This bank is under study for designation of Essential Fish Habitat, and benthic habitat maps are needed for this work. All the slopes and approximately 60% of the bank top were surveyed, yielding survey coverage of 76 sq. km. Figure 4 shows the multibeam coverage collected at East Brooks Bank.
 2. Due to marginal sea conditions at Necker Island only 2 days of surveying were attempted at that location. At Necker, a north-south transect approximately 0.5 km wide was surveyed immediately to the west of the island, yielding survey coverage of 9 sq. km. In addition, data were acquired to fill approximately half of the gaps between data acquired at 25 and 100 fathoms by the *Kilo Moana* in 2002. Figure 5 shows the multibeam survey on the bank top at Necker.

Refer to Appendix A for a detailed discussion of mapping methods and results.

- C. Recover and replace a SST and subsurface ODP at Necker Island and a CREWS buoy at French Frigate Shoals to allow remote long-term monitoring of oceanographic and environmental conditions affecting NWHI coral reef ecosystems.
1. Necker operations: The old ODP instrument plate was recovered and a new one installed on the existing anchor. The SST was not recovered as it was no longer present; however, a new SST was deployed using a new anchor and rigging assembly. An STR was attached to the SST anchor.
 2. French Frigate Shoals operations: The CREWS buoy was recovered and a new one installed on the old anchor using a new accumulator and rigging. An STR was attached to the CREWS subsurface mast. A “moored drifter” manufactured by Airborne Technologies, Inc. (ATI) was replaced using new rigging and the existing anchor as part of an ongoing field test.

Refer to Appendix B for additional information.

- D. Assess deployment of settlement plate arrays at the base of the ODP and CREWS moorings installed to examine temporal and spatial variability of benthic settlement along the Hawaiian Archipelago.
1. The settlement plate array affixed to the ODP at Necker Island could not be located or recovered. The practice of attaching arrays to ODPs will most likely be discontinued as stated in correspondence with Jean Kenyon.
 2. The settlement plate array connected to the CREWS anchor at French Frigate Shoals was damaged by the buoy's rigging. The array was recovered and 11 of 16 ceramic plates were stored and labeled for later analysis by Jean Kenyon.

Refer to Appendix B for additional information.

- E. Deploy two SPMD to document pathogens and chemical contaminants that may be transported in dust plumes from Asia and other sources.
1. The SPMD units were deployed at the established site as part of a study conducted by the U.S. Geological Survey (USGS). This is intended to be a 1-month deployment as part of a continuing time series. The SPMD will be retrieved in May during another cruise.

Refer to Appendix B for additional information.

- F. Test the ship's Trackpoint II USBL underwater navigation system in preparation for upcoming towed sensor surveys to be conducted on HI-05-04.
1. All equipment was tested and found to be working properly. System parameters were configured to accommodate *Hi'ialakai* infrastructure, and transponder frequencies were programmed into the Command/Diplay Module.
 2. Stationary test drops of transponders showed the tracked position to be consistent and reliable to within a few meters.
 3. Trackpoint II's depth calculation function was tested during a 200-m CTD cast, and comparisons to the pressure sensor on the SeaBird 9/11+ showed calculations to be accurate and responsive.
 4. Live tows were conducted at speeds between 1 and 3 knots, with up to 157 m of cable deployed. The transponder behaved consistently throughout the tows. Multibeam mapping continued during deployment of the hydrophone, and no degradation of data quality was observed.

See Appendix D for a detailed description of Trackpoint II.

SCIENTIFIC PERSONNEL:

Scott Ferguson, Engineer/Manager, Joint Institute for Marine and Atmospheric Research (JIMAR), University of Hawaii (UH), Pacific Islands Fishery Science Center (PIFSC), Coral Reef Ecosystem Division (CRED)
Joyce Miller, Oceanographer, JIMAR, UH, PIFSC, CRED
Jeremey Jones, Marine Ecosystem Specialist, JIMAR, UH, PIFSC, CRED
Joe Chojnacki, Marine Ecosystem Specialist, JIMAR, UH, PIFSC, CRED
Kyle Hogrefe, Marine Ecosystem Specialist, JIMAR, UH, PIFSC, CRED
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Emily Lundblad, GIS Specialist, JIMAR, UH, PIFSC, CRED
Allie Aaby, Mapping Specialist, JIMAR, UH, Hawaii Mapping Research Group
Rob O'Conner, GIS Specialist, JIMAR, UH, Pacific Islands Regional Office
Andrew Rapp, Survey Technician, NOAA Ship *Hi'ialakai*
Jeremy Taylor, Ordinary Seaman, NOAA Ship *Hi'ialakai*
John Shannon Byrne, Senior Engineer, SAIC
John Kiernan, Systems Engineer, SAIC

DATA COLLECTED:

High-resolution multibeam bathymetry and acoustic backscatter imagery from ship-based Kongsberg EM300 and EM3002D sonars
High-resolution multibeam bathymetry and acoustic backscatter imagery from launch-based RESON 8101 sonar
Acoustic Doppler Current Profile (ADCP) data
Videos of the seafloor from TOAD operations
CTD profiles of varying depths
Conductivity and temperature data from Seabird SBE37s retrieved from French Frigate Shoals CREWS and Necker ODP

Submitted by: _____
J. Scott Ferguson
Chief Scientist

Approved by: _____
David Kennedy
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Attachments

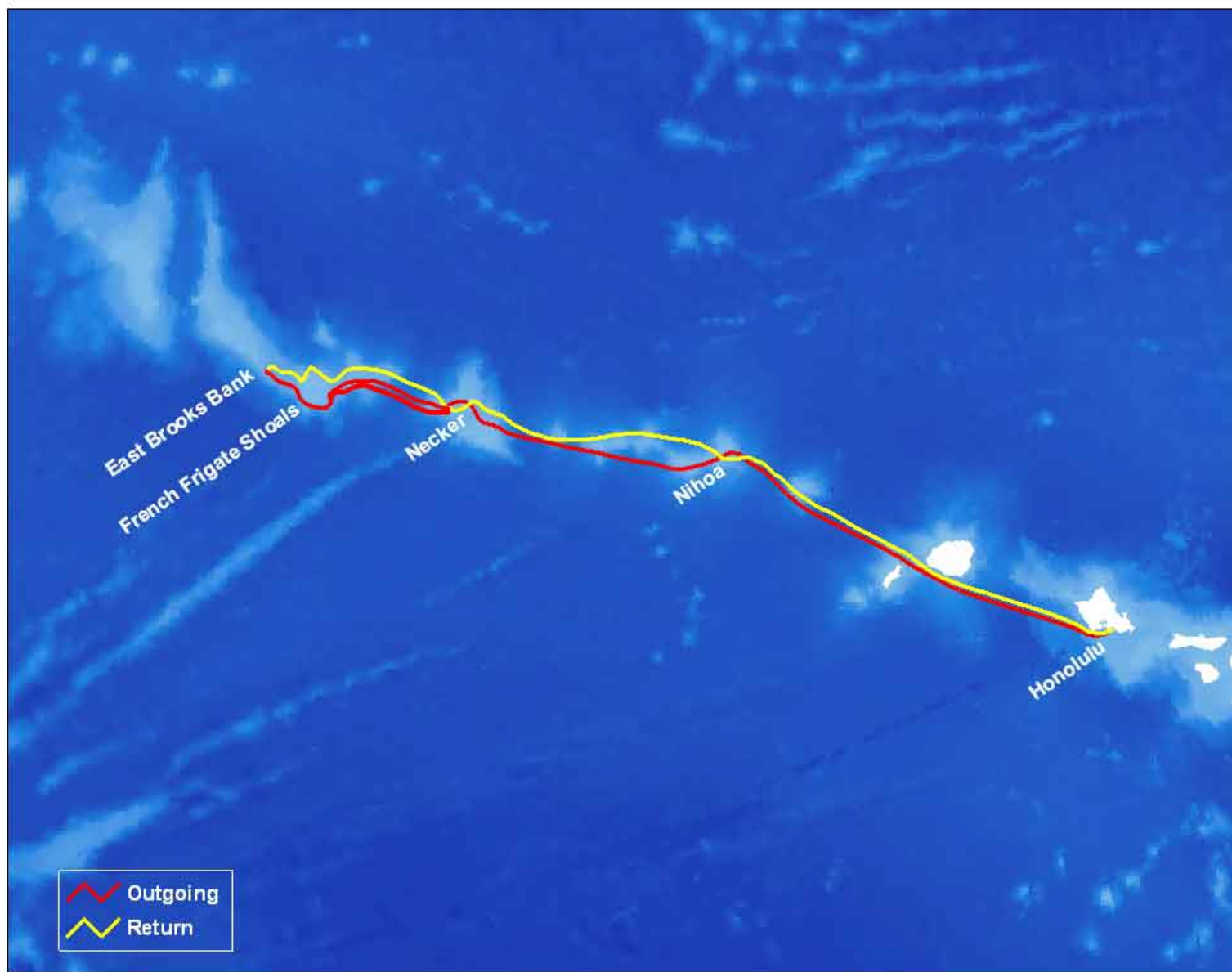


Figure 1: HI-05-01 Summary Cruise Track

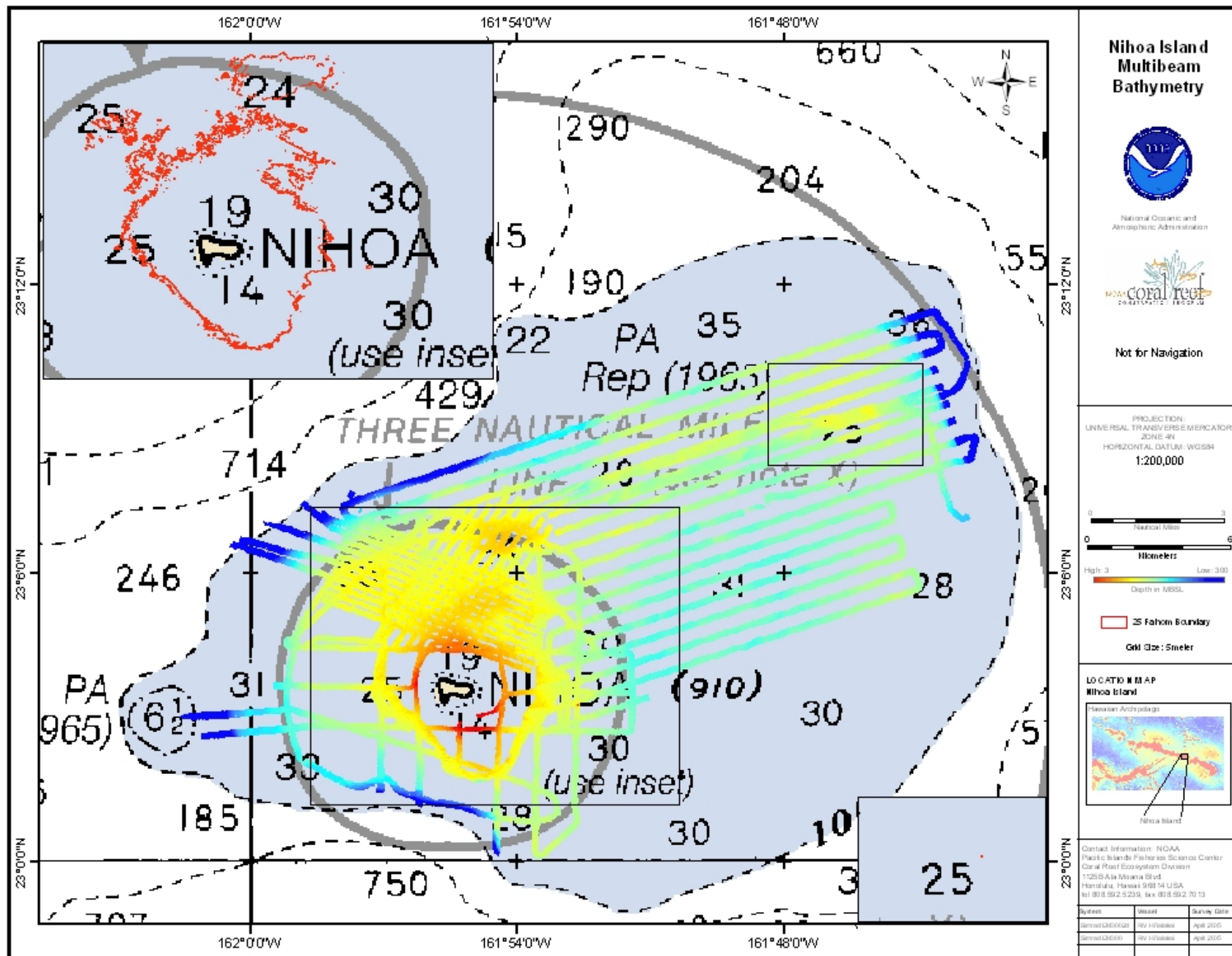


Figure 2: Niihoa Multibeam Bathymetry with 25-fathom Isobath

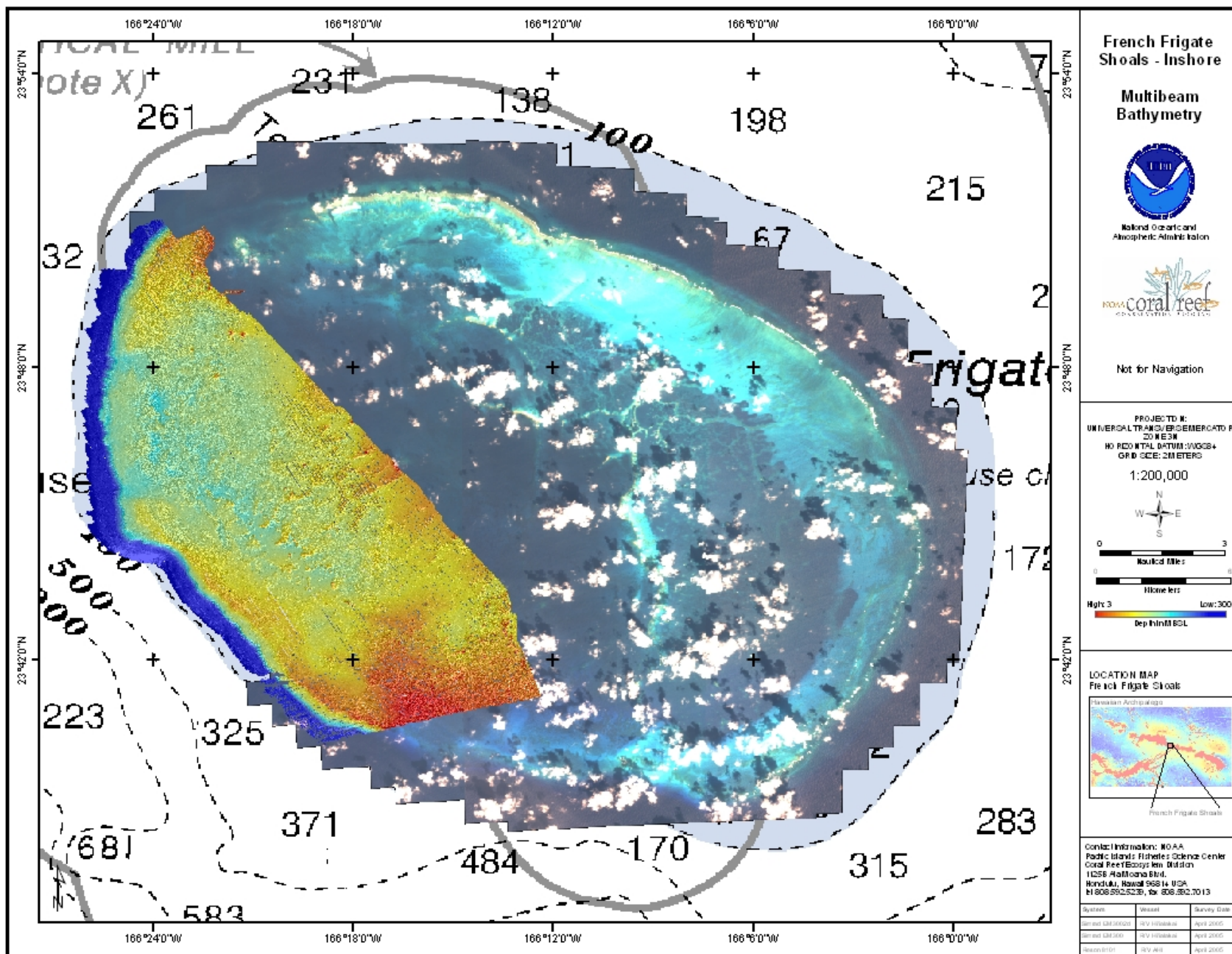


Figure 3: French Frigate Shoals Multibeam Bathymetry

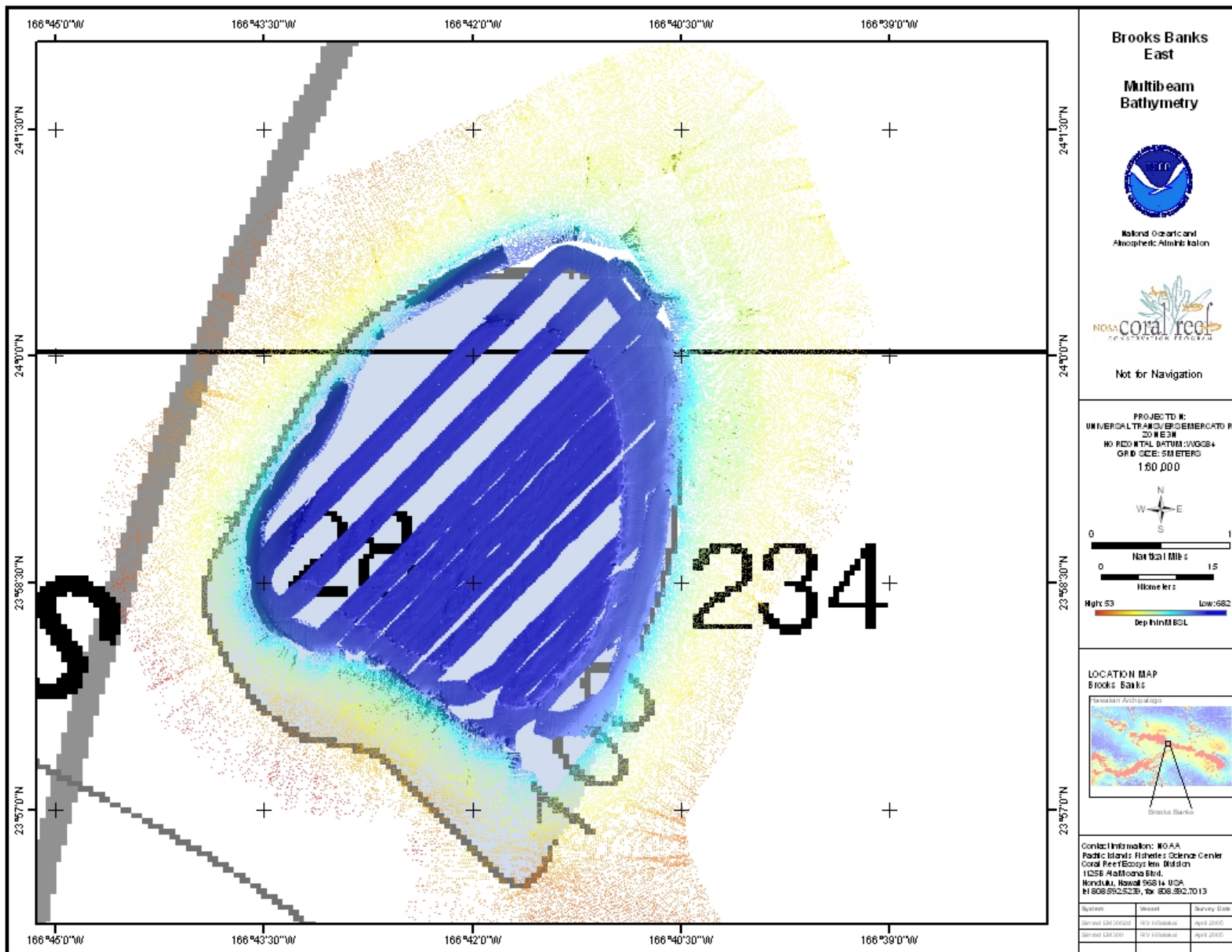


Figure 4: East Brooks Bank Multibeam Bathymetry

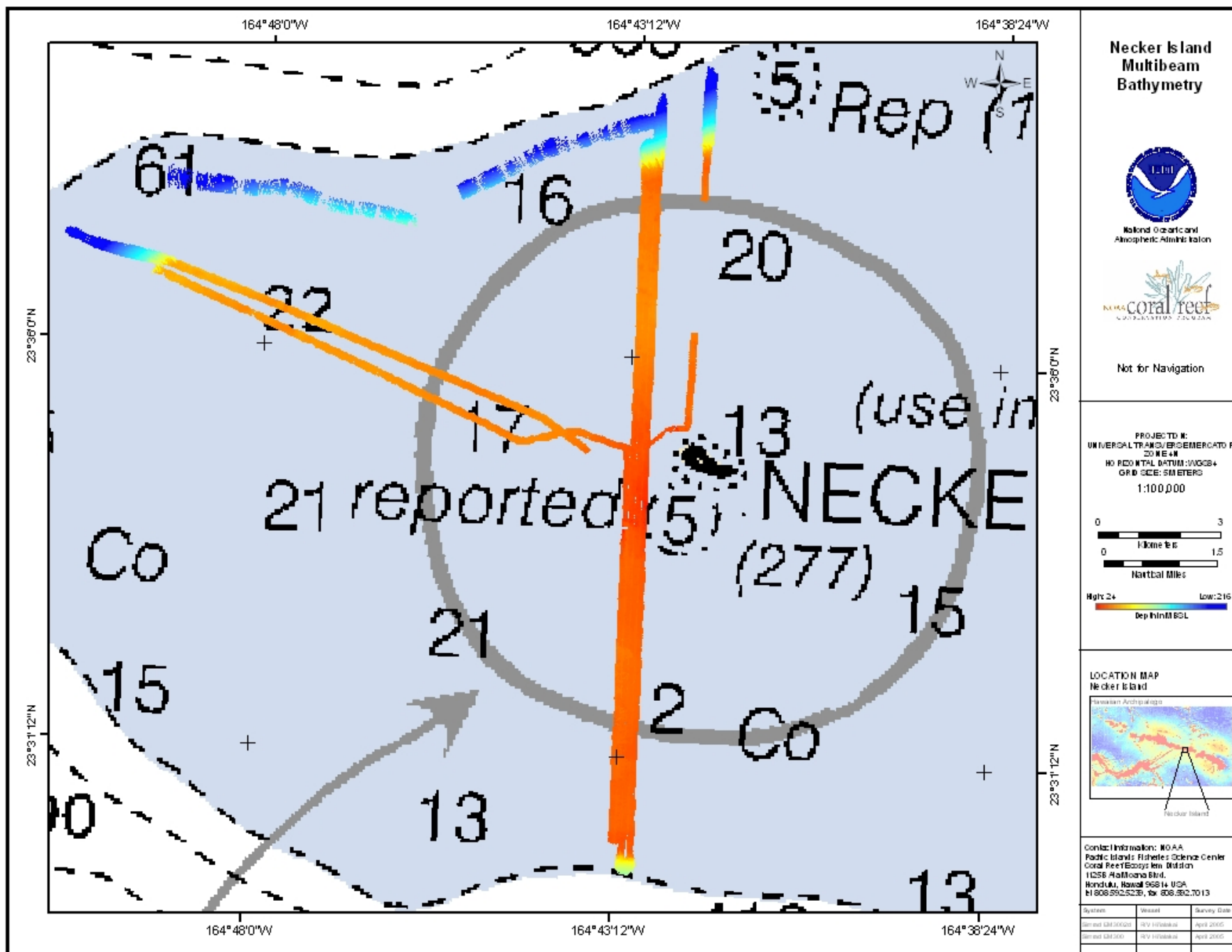


Figure 5: Necker Island Multibeam Bathymetry